CLAIMS

1. A two-dimensional photonic crystal optical multiplexer/demultiplexer using boundary reflection, comprising:

a) a slab-shaped body;

b) plural modified refractive index areas arranged periodically in the body, each having a refractive index different from that of the body;

c) a waveguide formed by creating defects of the modified refractive index areas in a linear arrangement;

d) a point-like defect formed by creating a defect of modified refractive index area in the vicinity of the waveguide; and

e) a first reflecting section provided at an end of the waveguide, and reflecting at least part of light with the resonant wavelength of the point-like detect.

2. The two-dimensional photonic crystal optical multiplexer/demultiplexer using boundary reflection according to claim 1, wherein the end of the waveguide provided with the first reflecting section is located on an end of the body.

3. The two-dimensional photonic crystal optical multiplexer/demultiplexer using boundary reflection according to claim 2, wherein the end of the body is in contact with an ambient space.

4. The two-dimensional photonic crystal optical multiplexer/demultiplexer using boundary reflection according to claim 2, wherein

another two-dimensional photonic crystal not transmitting light with the resonant wavelength of the point-like defect is connected to the end of the body.

5. The two-dimensional photonic crystal optical multiplexer/demultiplexer using boundary reflection according to one of claims 1 to 4, wherein the distance between the first reflecting section and the point-like defect is set so that the phase difference between light with the resonant wavelength of the point-like defect and reflected on the point-like defect, and light with the same wavelength passing over the point-like defect and reflected on the first reflecting section is π.

6. The two-dimensional photonic crystal optical multiplexer/demultiplexer using boundary reflection according to one of claims 1 to 4, wherein the distance between the first reflecting section and the point-like defect is set so that the phase difference between light with the resonant wavelength of the point-like defect and introduced into the waveguide from this point-like defect, and light with the same wavelength and reflected on the first reflecting section is 0.

7. The two-dimensional photonic crystal optical multiplexer/demultiplexer using boundary reflection according to one of claims 1 to 6, wherein a second reflecting section reflecting at least part of light with the resonant wavelength is formed at the end of the waveguide opposite to the first reflecting section.

8. The two-dimensional photonic crystal optical multiplexer/demultiplexer using boundary reflection according to claim 7, wherein the

distance between the second reflecting section and the point-like defect is set so that the phase difference between light with the resonant wavelength in the point-like defect and introduced from the second reflecting section side, and light with the same wavelength, introduced from the second reflecting section, reflected on the point-like defect, and further reflected on the second reflecting section is 0.

9. The two-dimensional photonic crystal optical multiplexer/demultiplexer using boundary reflection according to one of claims 1 to 8, wherein light with the resonant wavelength of the point-like defect is totally reflected on the first reflecting section, and the ratio Qp/Qv is set in the range of 1.4 to 2.8 where Qp is the coupling coefficient between the point-like defect and the waveguide, and Qv is the coupling coefficient between the point-like defect and the air.

10. The two-dimensional photonic crystal optical multiplexer/demultiplexer using boundary reflection according to claim 9, wherein the ratio of Qp/Qv is set to 2.

11. A two-dimensional photonic crystal optical multiplexer/demultiplexer using boundary reflection, comprising:

a) a slab-shaped body;

b) two or more forbidden band zones provided in the body;

c) plural modified refractive index areas provided in each of the forbidden band zones, each area having a refractive index different from that of the body, and periodically arranged in the body in a different cycle distance from each other in each of

the forbidden band zones;

d) a waveguide formed by creating defects of modified refractive index areas in a linear arrangement in the respective forbidden band zones, and passing through all the forbidden band zones;

e) a point-like defect created in the vicinity of the waveguide in each of the forbidden band zones; and

f) a first reflecting section provided at an end of the waveguide, and reflecting at least part of light with the resonant wavelength of the point-like defect,

wherein,

g) a part of a waveguide-transmittable wavelength band in each of the forbidden band zone is not included in a waveguide-transmittable wavelength band of all forbidden band zones present on the side of the first reflecting section from the forbidden band zone, but included in the waveguide-transmittable wavelength band of all forbidden band zones present on the side opposite to the first reflecting section from the forbidden band zone; and

h) the resonant wavelength of the point-like defect created in each of the forbidden band zones is included in the part of the transmission wavelength band.

12. The two-dimensional photonic crystal optical multiplexer/demultiplexer using boundary reflection according to claim 11, wherein the point-like defect is a linear donor-type cluster defect formed by rendering three adjacent modified refractive index areas defective.

13. The two-dimensional photonic crystal optical

multiplexer/demultiplexer using boundary reflection according to claim 11 or 12, wherein the end of the waveguide provided with the first reflecting section is located on an end of the body.

14. The two-dimensional photonic crystal optical multiplexer/demultiplexer using boundary reflection according to claim 13, wherein the end of the body is in contact with an ambient space.

15. The two-dimensional photonic crystal optical multiplexer/demultiplexer using boundary reflection according to claim 13, wherein another two-dimensional photonic crystal not transmitting light with the resonant wavelength of the point-like defect is connected to the end of the body.

16. The two-dimensional photonic crystal optical multiplexer/demultiplexer using boundary reflection according to one of claims 11 to 15, wherein, in the forbidden band zones except the forbidden band zone to which the first reflecting section belongs, the distance between the boundary with an adjacent forbidden band zone on the first reflecting section side and the point-like defect provided in that forbidden band zone is set so that the phase difference between light with the resonant wavelength of the point-like defect of the forbidden band zone and reflected on the point-like defect, and light with the same wavelength passing over the point-like defect and reflected on the boundary between the forbidden band zones or the first reflecting section is π; and wherein, in the forbidden band zone to which the first reflecting section belongs, the distance along the waveguide between the first reflecting

section and the point-like defect provided in this forbidden band zone is set so that the phase difference between light with the resonant wavelength of the point-like defect of the forbidden band zone and reflected on this point-like defect, and light with the same wavelength, passing over the point-like defect, and reflected on the boundary between the forbidden band zones or the first reflecting section, is π.

17. The two-dimensional photonic crystal optical multiplexer/demultiplexer using boundary reflection according to one of claims 11 to 15, wherein in the forbidden band zones except the forbidden band zone to which the first reflecting section belongs, the distance between the boundary with an adjacent forbidden band zone on the first reflecting section side and the point-like defect provided in that forbidden band zone is set so that the phase difference between light with the resonant wavelength of the point-like defect of the forbidden band zone, and introduced into the waveguide from this point-like defect, and light with the same wavelength and reflected on the boundary between the forbidden band zones or the first reflecting section, is 0; and wherein, in the forbidden band zone to which the first reflecting section belongs, the distance in the length of the waveguide direction between the first reflecting section and the point-like defect provided in a forbidden band zone is set so that the phase difference between light with the resonant wavelength of the point-like defect of the forbidden band zone, and introduced into the waveguide from this point-like defect, and light with the same wavelength and reflected on the boundary between the forbidden band zones or the first reflecting section, is 0.

18. The two-dimensional photonic crystal optical

multiplexer/demultiplexer using boundary reflection according to one of claims 11 to 17, wherein the ratio Qp/Qv is set in the range of 1.4 to 2.8, where Qp is a coupling coefficient between the point-like defect and the waveguide in each of the forbidden band zones and Qv is a coupling coefficient between the point-like defect and the air.

19. The two-dimensional photonic crystal optical multiplexer/demultiplexer using boundary reflection according to claim 18, wherein the ratio of Qp/Qv is set to 2.

20. The two-dimensional photonic crystal optical multiplexer/demultiplexer using boundary reflection according to claim 18 or 19, wherein light with the resonant wavelength of the point-like defect of the forbidden band zone to which the first reflecting section belongs is totally reflected on the first reflecting section.